Contents

Preface xiii

Contents xiv

Chapter 1. Nonlinear dynamics

Periodic, aperiodic, and transient patterns in vibrated granular layers
P.B. Umbanhowar, F. Melo and H.L. Swinney 1

Propagating solitary states in highly dissipative driven fluids
J. Fineberg and O. Lioubashevski 10

Experiments on spatio-temporal chaos
G. Ahlers 18

Ordered and disordered defect chaos
G.D. Granzow and H. Riecke 27

Particle dispersion in a multidimensional random flow with arbitrary temporal correlations
G. Falkovich, V. Kazakov and V. Lebedev 36

Excitable medium with left–right symmetry breaking
C. Dupont, K. Agladze and V. Krinsky 47

The dynamics of Dictyostelium development
H. Levine 53

Dynamics of voltage-gated ion-channel proteins
E. Braun 64

Morphology diagram of possible structures in diffusional growth
E. Brener, H. Müller-Krumbhaar, D. Temkin and T. Abel 73

Morphology transitions in a liquid crystal
J. Bechhoefer and J.L. Hutter 82

Stochastic resonance and ratchets – new manifestations
V. Berdichevsky and M. Gitterman 88

Wrinkling of stable fronts in viscous flow
I. Webman and D.A. Kessler 96

Formation of periodic and localized patterns in an oscillating granular layer
I.S. Aranson and L.S. Tsimring 103

Separation and pattern formation in hydraulic jumps
T. Bohr, C. Ellegaard, A.E. Hansen, K. Hansen, A. Haaning, V. Putkaradze and S. Watanabe 111

Kinematic equations for front motion and spiral-wave nucleation
A. Hagberg and E. Meron 118

Spiral dynamics in pattern-forming systems: mean-flow effects
L.S. Tsimring 125

On the breakup of target and spiral waves on a disk in a reaction–diffusion system with long-range interaction
O. Nekhamkina and M. Sheintuch 134

Long-wave instability in optical parametric oscillators
Z.H. Musslimani 141

Rotating convection at moderate Prandtl number
Y. Ponty, T. Passot and P.L. Sulem 146

Directed chaotic motion in a periodic potential
O. Farago and Y. Kantor 151

Biased chaotic diffusion
E. Barkai and J. Klafter 156

Arbitrary-dimensional spike autosolitons
V.V. Osipov and A.V. Severtsev 162

The power dependence of auto-oscillations due to modulation instability in perpendicularly magnetized YIG films
I. Laulicht and Y. Kraftmakher 167

Propagation of Turing–Hopf fronts
M. Or-Guil and M. Bode 174

Stability of non-equilateral hexagonal patterns governed by generalized amplitude equations
A.E. Nuz, A.A. Nepomnyashchy and L.M. Pismen 179

Stick–slip dynamics of interfacial friction
M.G. Rozman, M. Urbakh and J. Klafter 184

Interferometric measurement of the temperature field in the vicinity of ice crystals growing from supercooled water
I. Braslavsky and S.G. Lipson 190

Chapter 2. Soft condensed matter

The dynamics of reactive wetting on solid surfaces
P.G. de Gennes 196

Liquid-to-solid transitions in thin liquid films induced by confinement
J. Klein and E. Kumacheva 206

Complex formation between DNA and cationic surfactant
A.V. Gorelov, E.D. Kudryashov, J.-C. Jacquier, D.M. McLoughlin and K.A. Dawson 216

The equations of stress in a granular material
S.F. Edwards 226

Subharmonic surface waves in vibrated granular media
D.C. Rapaport 232

Microstructure and phase diagrams of polymer gels
S. Panyukov and Y. Rabin 239

Static inhomogeneities and dynamic fluctuations of temperature sensitive polymer gels
M. Shibayama, S.-i. Takata and T. Norisuye 245

Protein-like copolymers: computer simulation
A.R. Khokhlov and P.G. Khalatur 253

Gels under strong deformation
K. Sekimoto 262

What is a solid?
S. Alexander 266

Stress propagation in sand
M.E. Cates and J.P. Wittmer 276

Interfaces and grain boundaries of lamellar phases
S. Villain-Guillot, R.R. Netz, D. Andelman and M. Schick 285

Interfaces in partly compatible polymer mixtures: a Monte-Carlo simulation approach
K. Binder, M. Müller, F. Schmid and A. Werner 293

Necklace model of randomly charged polymers
Y. Kantor, M. Kardar and D. Ertaş 301

Thermodynamic and kinetic properties of water–oil–surfactant mixtures
D. Vollmer and J. Vollmer 307

Adsorption of polyelectrolytes and inter-colloidal forces
I. Borukhov 315

Phase diagram of microphase-separated multiblock copolymers
S. Panyukov and I. Potemkin 321

Copolymer networks: the spectrum of scaling dimensions
C. von Ferber and Yu. Holovatch 327

Flow-induced alignment of rod-like and flexible polymers in the molten state
M. Kröger 332

Winding-angle distribution for two-dimensional polymers at the -point
T. Prellberg and B. Drossel 337

Long-term viscoelastic response in physically aging amorphous polymers
A.D. Drozdov 342

Structure and dynamic behavior of protein molecules in solution
I.V. Ermolina, V.D. Fedotov and Yu.D. Feldman 347

Numerical analysis of phase transitions in a random copolymer
A. Moskalenko, Yu.A. Kuznetsov and K.A. Dawson 353

Glass transition in random copolymers
A. Moskalenko, Yu.A. Kuznetsov and K.A. Dawson 358

Combined SANS and SAXS experiments in polyolefins-hydrogenated oligocyclopentadiene (HOCP) blends
A. Triolo, J.S. Lin and R. Triolo 362

Model for the order–disorder transition in charged colloidal suspension
D.B. Lukatsky and V.N. Bondarev 369

The collapse transition in the HP model
R.J. Najmanovich, J.L. deLyra and V.B. Henriques 374

Isotropic–nematic–smectic: importance of being flexible
A. Tkachenko 380

Segregation and coarsening of granular mixture in a rotating tube
B. Levitan 386

Modeling stratification in two-dimensional sandpiles
H.A. Makse, P. Cizeau and H.E. Stanley 391

Chapter 3. Statistical physics of biological systems

Realistic models of biological motion
I. Derényi and T. Vicsek 397

The cybernetic genome
E. Ben-Jacob 407

Normal modes analyses of macromolecules
D. ben-Avraham and M.M. Tirion 415

Molecular motion through correlated fluctuating bottlenecks
N. Eizenberg and J. Klafter 424

Analysis of DNA sequences using methods of statistical physics
S.V. Buldyrev, N.V. Dokholyan, A.L. Goldberger, S. Havlin, C.-K. Peng, H.E. Stanley and G.M. Viswanathan 430

What can we learn with wavelets about DNA sequences?
A. Arneodo, Y. D'Aubenton-Carafa, B. Audit, E. Bacry, J.F. Muzy and C. Thermes 439

Interpreting correlations in biosequences
H. Herzel, E.N. Trifonov, O. Weiss and I. Große 449

Statistical physics and Alzheimer's disease
H.E. Stanley, S.V. Buldyrev, L. Cruz, T. Gomez-Isla, S. Havlin, B.T. Hyman, R. Knowles, B. Urbanc and C. Wyart 460

Phenomenological theory of mortality and aging
M.Ya. Azbel 472

Time–frequency analysis of transient signals–application to cardiovascular control
L. Keselbrener and S. Akselrod 482

Multiple-time scales analysis of physiological time series under neural control
C.-K. Peng, J.M. Hausdorff, S. Havlin, J.E. Mietus, H.E. Stanley and A.L. Goldberger 491

Fractal aggregation in aqueous solutions of porphyrins
N. Micali, L. Monsu' Scolaro, A. Romeo and F. Mallamace 501

3-, 10.5-, 200- and 400-base periodicities in genome sequences
E.N. Trifonov 511

Interface growth and pattern formation in bacterial colonies
M. Matsushita, J. Wakita, H. Itoh, I. Ràfols, T. Matsuyama, H. Sakaguchi and M. Mimura 517

Markov processes and linguistics
M. Halibard and I. Kanter 525

Membrane curvature induced by polymers and colloids
R. Lipowsky, H.-G. Döbereiner, C. Hiergeist and V. Indrani 536

Molecular evolution modeled as a fractal statistical process
B.J. West and D.R. Bickel 544

Bacterial wisdom
E. Ben-Jacob 553

Mutual catalysis in sets of prebiotic organic molecules: Evolution through computer simulated chemical kinetics
D. Segré, Y. Pilpel and D. Lancet 558

Supercycles, strange attractors and chaos in a standard model of population genetics
V. Kirzhner, B.I. Lembrikov, A. Korol and E. Nevo 565

Membrane-mediated protein attraction. A Monte-Carlo study
T. Sintes and A. Baumgärtner 571

Protein stability and foldability–designability complementarity
M. Vendruscolo 576

Long-range correlation measures for quantifying patchiness: Deviations from uniform power-law scaling in genomic DNA
G.M. Viswanathan, S.V. Buldyrev, S. Havlin and H.E. Stanley 581

Scaling and universality in heart rate variability distributions
P.Ch. Ivanov, M.G. Rosenblum, C.-K. Peng, J.E. Mietus, S. Havlin, H.E. Stanley and A.L. Goldberger 587

Model of unequal chromosomal crossing over in DNA sequences
N.V. Dokholyan, S.V. Buldyrev, S. Havlin and H.E. Stanley 594

Spatio-temporal dynamics of networks of heart cells in culture
N. Cohen, Y. Soen and E. Braun 600

List of invited talks 605
List of contributors 609